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A PRELIMINARY REPORT ON THE DISTRIBUTION OF FRESHWATER FISH OF THE CONGO RIVER: BASED ON THE OBSERVATION OF LOCAL MARKETS IN BRAZZAVILLE, REPUBLIC OF THE CONGO

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ABSTRACT This article presents a report on the distribution process of freshwater fish in Brazzaville, a modern-day city in central Africa, by focusing on the trading strategies of fish vendors. Freshwater fish is a major source of protein for the dwellers of this city, and is therefore an important component of their food. This fish is available in three forms at the local markets of Brazzaville: (1) fresh fish, (2) smoked fish, and (3) salted dried fish. Each form has its own transportation and distribution system. Fish vendors with different form of merchandise employ different trading strategies. Smoked fish and salted dried fish vendors are highly specialized and tend to develop strong relationships with specific middlemen. These relationships are often cultivated through ethnic ties based on the area of origin. Fresh fish vendors are more opportunistic in selling items and trading relationships. Future studies should explore how increased demand for fish in urban areas and the strong trading relationships are impacting the sustainability of aquatic resource use.

Key Words: Animal protein; Freshwater fish; Urbanization; Trade relationships; Local market.

INTRODUCTION

People living in the tropical forests of the Congo Basin derive their quota of protein from the consumption of wild animals and fish, which are locally consumed and traded between people such as hunter-gatherers, farmers, and fisher-folks (e.g., Ankei, 1984; Oishi, 2014). Importance of freshwater fish in local livelihoods, however, had long been overlooked compared to that of bushmeat. Since 1970s, commercial logging and other development projects resulted in a patchy increase and concentration of population inside the tropical forests. Increase in the demand for animal protein sources in urban areas led to increase in commercial hunting activities, which were further bolstered by the construction of roads in remote villages. Bushmeat and fish became sole sources of cash income for local people in areas where agricultural development was difficult. In the mid-1990s, to reduce the high impact of hunting on forest mammals, central African countries established forest laws that enforced regulations on hunting. Aquatic resources emerged as an alternative animal protein source to bushmeat. Republic of the Congo has recently started increasing domestic production of aquatic resources for local consumption as well as exports in the future (Oeil d’Afrique, 2013).

Studies conducted on local fisheries in southeastern Cameroon have highlighted the increase in commercial fishing activities by migrants from other areas (Inai, 2010) in addition to subsistence-oriented fishing by local farmers and hunter-gatherers (Makazi et al., 1998; Oishi, 2010). Commercially specialized fishing activities target specific species, impacting local aquatic communities (Brummett et al., 2010). However, there is still not much clarity about the distribution process and the consumption of freshwater fish in the cities in tropical Africa.

Abbott et al. (2007) investigated the livelihoods of fish vendors who trade at the local market of the Zambezi River floodplain in southern Africa. As the volume of regional catch frequently fluctuates and the supply of fish does not match its demand, most fish vendors who are from the households of fisher-folks do not develop specific relationships with fishers or middlemen, and instead procure fish in various ways to maintain their merchandises. Although fish is still consumed within the floodplain area, the number of vendors and value of fish sales is continuously growing, in turn having an increasing impact on aquatic resources. Compared to floodplains in the arid zone, there have been few studies on commercial fishing in the tropical rainforest zone. Especially, the connection between urban markets and resource production has not been well explored. In order to get a better idea of commercial fishing, we have conducted an analysis of the urban local markets in the Republic of the Congo since 2011, with focus on demand from such areas. This article presents preliminary results about the distribution and consumption process of freshwater fish in a modern-day city of central Africa, with emphasis on the trading strategies of fish vendors.

STUDY AREA AND METHODS

Study Area: Brazzaville

Brazzaville, the capital of the Republic of the Congo, was chosen for field research. The city's population stands at 1.37 million, which is 37% of the country's total population of 3.7 million (CNSEE, 2007). Brazzaville has seen considerable population growth since the end of the civil war in the early 2000s. The city is located on the shore of the Congo River, and is adjacent to Kinshasa, the capital of the Democratic Republic of the Congo, which is home to more than 9 million people. Demand for animal protein source has been quite high among the urban populace of Brazzaville and Kinshasa.

Although there are many local markets in Brazzaville, we focused on the major four local markets of Moungali, Ouenze, Total, and Talangai⁽¹⁾ (Fig. 1). As aquaculture is not developed in Congo, freshwater fish is mainly produced by local fisheries. Most of the freshwater fish produced in the northern part of the country (i.e. Departments of Plateaux, Cuvette, Sangha, and Likouala) is first accumulated at the Bouemba wholesale market in northern Brazzaville. Every Wednesday, vendors purchase fish from the market and carry it to the local markets for retail.

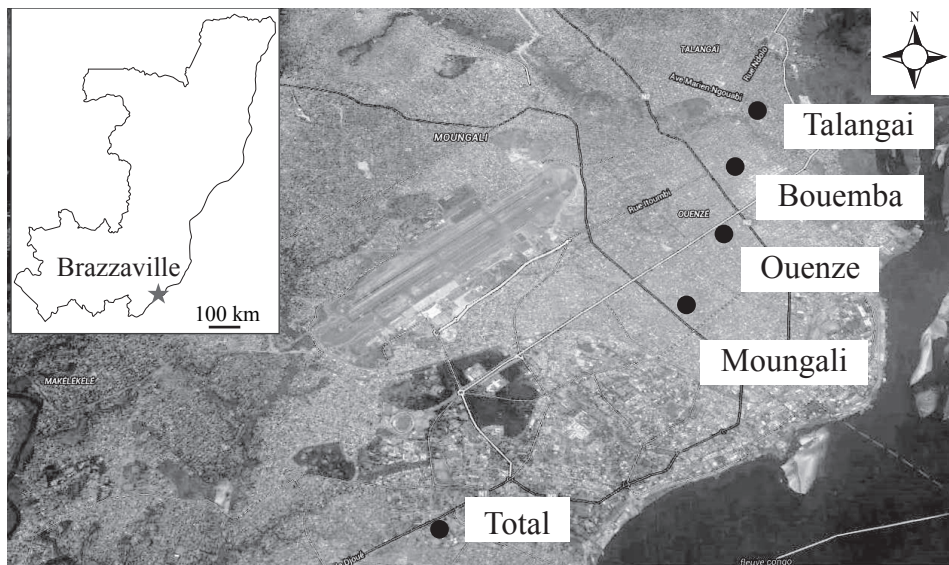


Fig. 1. Location of study area and distribution of local markets in Brazzaville.

Food Consumption of Urban Population

To assess the animal food consumption and the contribution of freshwater fish, we conducted a food consumption survey using self-report questionnaire sheet. From various localities and economic class,⁽²⁾ ten households were chosen. To record the food materials and the way of cooking of each household, a female informant who mainly cooks for a given household was asked to write down what she prepared as side dishes⁽³⁾ in the sheet. Informants used Lingala or French to fill the sheets. Questionnaire sheets are periodically collected from informants by research assistants every week in exchange of 1,500 FCFA⁽⁴⁾ (equivalent to 2.5–3.0 US dollars). After a trial period of one to two weeks, the survey continued from November 2011 to March 2012. The age of informant was 30.9 year-old in average (range 15–63, SD = 14.5). Half of informants are from the southern part of the country (Baongo, Vili, Kamba), while the other half are from the northern part of the country (Mboshi, Mossaka, Téké, and Mbeti). The household size was 5.88 in average (range 3–10, SD = 2.64). Of the ten households, four held one or two of employed persons among them.

Baseline Survey on Fish Vendors at Local Markets

We deployed the participant observation and questionnaire-based structured interview methods. The number of vending slots available is limited in the local markets. To evaluate the relative importance of freshwater fish trade, the number of vending slots to each item of merchandise related to animal foods is counted.

We interviewed 50 fish vendors at the local markets according to their demography (sex, age, marital status, number of children), working style (subsistence complex, seasonality, length of fish sales experience), trading relations, and free list of preferred fish species for sales.

Field research was conducted for a total of two months, spread across October 2011, November 2011, March 2012, and December 2012. The intensive survey with fish vendors was conducted for two weeks in the middle of December 2012. We used Lingala and French for data collection.

RESULTS

Freshwater Fish as a Source of Animal Protein: Trends in Consumption

Food consumption survey clearly showed a large impact of preservation technology innovation, especially refrigerated transportation and storage, on the city dwellers' animal protein procurement. Frequency of animal food items in side dishes for the ten households in Brazzaville city is shown in Fig. 2(a). Of 1,158 side dishes prepared, 570 (49.2%) were made from frozen foods. Major part of consumed frozen food consists of beef, sea fish, and chicken (Fig. 2(b)). The origin of these frozen foods is often not clear. Urban people believe that frozen foods that come from long distance contains much antiseptic chemicals and so not good to health.

Other than frozen foods, freshwater fish (344, 29.7%), bushmeat (158, 13.6%), and fresh livestock meat (51, 4.4%) were consumed. Of 344 freshwater fish meals, smoked fish (204, 59.3%) and salted dried fish (114, 33.1%) were dominant food materials and consumption of fresh fish (23, 6.7%) was not so often (Fig. 2(c)). These locally produced animal foods tend to be considered as safe and healthy compared to the refrigerated animal foods.

Freshwater Fish as Merchandise: Retail Sales at Local Markets

Local markets are controlled by the city services and market merchants' association. Vendors need to pay tax to occupy a vending slot of ca 1.5–2 square meters. Table 1 shows the number of vending slots that sold animal protein sources in the middle of December 2012. Of the 905 slots, freshwater fish (474, 52.4%) and sea fish (349, 38.6%) accounted for the majority, whereas other protein sources were sold at a small number of vending slots. Their distribution was as follows: bushmeat 44 (4.9%); chicken 21 (2%); and raw beef 10 (1.1%).⁽⁵⁾ Among livestock meat, chicken packed in nylon bags was imported from southern American countries such as Uruguay and Brazil. Beef and pork was also sold in larger blocks at meat shops in outdoor markets. Therefore, we cannot compare the importance of each item only by the number of vending slots. The results, however, demonstrate the importance of freshwater fish in the trade of animal protein source at the urban local markets, in contrast to bushmeat whose distribution is limited and regulated by nature conservation policies.

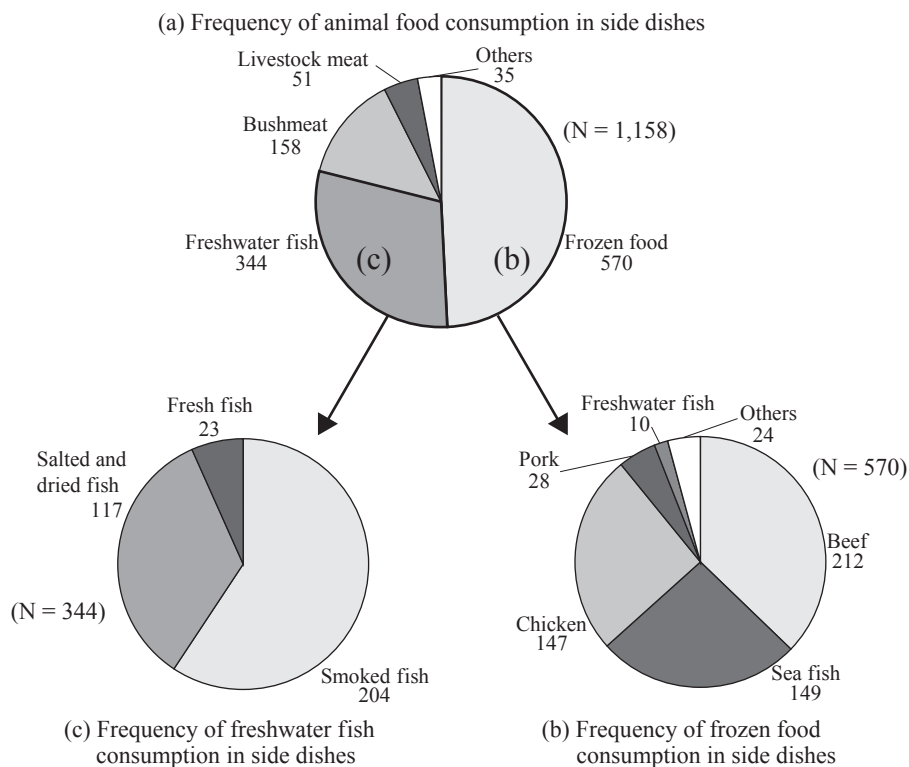


Fig. 2. Frequency ratio of animal protein food items appeared in the food diary.

Table 1. Composition of vending slots for animal protein sources at four local markets of Brazzaville in December 2012

Market	Salted and dried fish			Fresh freshwater fish	Refrigerated sea fish	Bushmeat	Shrimp	Raw beef	Refrigerated chicken
	Smoked freshwater fish	Freshwater fish	Imported sea fish						
Talangai	24	0	1	16	21	1	1	n.d.	n.d.
Ouenze	82	3	50	53	n.d.	7	1	n.d.	n.d.
Total	137	0	29	24	150	21	2	n.d.	n.d.
Mungali	102	6	35	27	63	15	3	10	21
Total	345	9	115	120	234	44	7	10	21
(%)	(38.1)	(1.0)	(12.7)	(13.3)	(25.9)	(4.9)	(0.8)	(1.1)	(2.3)

Total number is 905.

Of the 830 vending slots for fish, tables for smoked freshwater fish accounted for 345 (41.6%), refrigerated fish (“*poisson congelé*” in French) 234 (28.2%), fresh freshwater fish (“*mbisi ya mai*” in Lingala) 120 (14.5%), salted dried codfish (*makayabu norweige*)⁽⁶⁾ 115 (13.9%), and salted dried freshwater fish (*makayabu ya mbisi ya mai*) 9 (1%). Smoked freshwater fish is expensive but popular among Brazzaville citizens (Fig. 3). Most of the refrigerated fish were saltwater fish such as horse mackerel, white croaker, and harvest fish, except for *Pangasius* spp.,⁽⁷⁾ which is brought by Chinese merchants and might be imported from southeastern Asia.

Transportation and distribution of freshwater fish

Freshwater fish are classified into three forms at the local markets: (1) fresh fish (*mbisi ya mai*), (2) smoked fish (*mokalu ya mbisi ya mai*), and (3) salted dried fish (*makayabu ya mbisi ya mai*). Each item is sold in different selling spaces in the market. Average retail price (FCFA/kg) for each form was 3,958.3 (range 1,302.1–8,108.1, $N = 27$, $SD = 1,636.5$) for fresh fish, 7,327.9 (range 1,388.9–11,990.4, $N = 82$, $SD = 1,918.6$) for smoked fish, and 4,059 (range 1,748.3–5,483.9, $N = 9$, $SD = 1,016.6$) for salted dried fish, respectively.⁽⁸⁾ Smoked fish is sold most expensive among these three forms and its price is comparable to that of bushmeat with 7,087 FCFA/kg (range 4,555.8–11,475.4, $N = 17$, $SD = 2,106.7$). We observed 28 categories of freshwater fish named in Lingala and sold at the local markets (Table 2). Some species are sold in particular forms. For example, most of the salted dried fish are made from African arowana (*Herotis niloticus*: *kongoyasika*) and African lungfish (*Propterus annectens*: *djombo*).

Among freshwater fish, there are species that cannot live longer after catch. Such species are supplied by local fishermen who carry out fishing activities in the Congo River opposite Brazzaville. Fish vendors visit the river's shore early morning and procure fresh fish from fishermen or middlemen for sale to the local markets. Species that can live for a long time after catch, such as Clarid catfish and African lungfish, are transported alive from the upper stream of the Congo, Ubangui, and Sangha rivers in boats (Fig. 4). According to the trader we interviewed at a port, some fish come from areas surrounding Bangui in the Central African Republic, which is more than 1,000 km away from Brazzaville.

Smoked fish (*mokalu ya mbisi ya mai*) is a principal form of preservation and distribution used in long-distance trade.⁽⁹⁾ Using this technique of preservation, fish can be conserved for months if it has been smoked well at fishing camps near the production area. Middlemen collect smoked fish from fishing communities settled along the Congo River and transport them by truck along with other foods, such as staple items (cassava, plantains etc.) and livestock (goats and pigs) (Fig. 5). The trucks also carry fish vendors belonging to the fishing communities, who want to sell smoked fish directly at the wholesale market of Bouemba.

Besides fresh fish and smoked fish, salted dried freshwater fish (*makayabu ya mbisi ya mai*) is distributed widely (Fig. 6). Salted and dried cod fish imported from northern Europe (Sweden and Norway) is termed Nordic salted dried fish (*makayabu norweige*). In what seems like a recent development, the preservation technique of saltwater fish is now also applied to freshwater fish. As salted dried fish contains high concentration of salts, it requires desalting before cooking.



Fig. 3. Smoked freshwater fish sold at local market (October 2011).

Table 2. Freshwater fish species observed at local markets and their forms of distribution

No.	Lingala name		Scientific name	Form of distribution*		
	singular	plural		(1) Fresh	(2) Smoked	(3) Salted & dried
1	ndjombo	ba.ndjombo	<i>Protopterus annectens</i>	+	+	+
2	konga	ba.konga	<i>Polypterus</i> spp.	Rare	+	—
3	kongoyasika		<i>Herotis niloticus</i>	+	Rare	+
4	malembe		Notopteridae	—	+	—
5	peke		Notopteridae	—	+	—
6	mbese	ba.mbese	Mormyridae	+	+	—
7	nianda		<i>Campromormyrus</i> spp.	+	+	—
8	mokobi	mi.kobi	<i>Hydrocynus vittatus</i>	+	Rare	Rare
9	nbenga	ba.nbenga	<i>Hydrocynus</i> spp.	Rare	Rare	Rare
10	liyanga	ma.yanga	<i>Citharinus</i> spp.	+	+	—
11	mboto		<i>Distichodus</i> spp.	+	+	—
12	dabu		<i>Labeo</i> sp.?	+	+	+
13	monganza	mi.nganza	<i>Labeo</i> spp.	+	+	+
14	mopongo		<i>Labeo</i> sp.	+	—	—
15	kamba	ba.kamba	<i>Chrysichthys cranchii</i>	+	—	—
16	musharo	ba.musharo	<i>Chrysichthys</i> spp.	+	+	—
17	lilangua	ma.langua	Schilbeidae	+	+	—
18	chuni	ba.chuni	<i>Heterobranchus longifilis</i>	+	—	—
19	libongo		<i>Clarias</i> spp.	+	+	—
20	mongambili	banmingambili	?	+	—	—
21	ngolo	ba.ngolo	<i>Clarias</i> spp.	+	+	—
22	senga		<i>Clarias gariepinus</i>	+	+	—
23	mboka	ba.mboka	<i>Auchenoglanis occidentalis</i>	+	+	+
24	nina	ba.nina	<i>Malapterurus electricus</i>	+	Rare	—
25	ikoko	ma.koko	<i>Synodontis</i> spp.	+	+	—
26	mongusu/ singa		<i>Parachanna obscura</i>	+	+	+
27	libundu	ma.bundu	Cichridae	+	+	—

*Species and/or group that is observed for each form of distribution is shown with the sign of “+” and that is not observed is shown with “—”. Sign of “Rare” means that is observed but rare.



Fig. 4. Middle person transports African lungfish (*Protopterus annectens*: *djombo*) for weeks in living condition on boat.



Fig. 5. A truck fully loaded with smoked fish, agricultural products, and livestock.



Fig. 6. Salted dried freshwater fish of African arowana (*Herotis niloticus*: *kongoyashika*).

Demographic and Sociological Characteristics of Fish Vendors

Of the 50 vendors of freshwater fish (average age: 42; SD = 11), 48 (96%) were married or widows. The fish vendors had considerable experience of selling fish at the local markets (average experience: 16.7 years; SD = 11). While vendors of fresh fish also engaged in the sales of general fresh foods such as plantain banana and vegetables, most of the vendors dealing smoked fish specialized only in smoked fish. Sales from smoked fish are a primary source of cash income for vendors who are often the main breadwinners of their households (24 of 34 smoked fish vendors, 70%). Ethnic groups of Mbossi, Téké, Moye, and Gongulu constitute the majority of fish vendors, which indicates that many of them are from fish producing areas.

All smoked fish vendors who were interviewed procured smoked fish from the Bouemba wholesale market. Of the 34 smoked fish vendors, 31 (91.2%) purchased fish on credit from middlemen. The remaining three of Lari ethnicity⁽¹⁰⁾ purchased in cash. The average number of trading partners (middlemen) was 2.58 (range: 1–6; SD = 1.05).

All four vendors of salted dried fish purchased fish from middlemen. Three of them purchased fish on credit, and one by cash. The average number of trading partners (middlemen) was 2.75 (range 2–4; SD = 0.96).

Vendors of fresh fish procured fish from multiple sites, such as ports of various locations and the Bouemba wholesale market. Of the 20 fresh fish vendors, 13 (65%) purchased fish from middlemen on credit and 7 (35%) from fishermen by cash and/or on credit. The average number of trading partners (middlemen) was 2.23 (range 0–4; SD = 1.09). These results suggest a tendency of segmentation of distribution system based on ethnicity and common ties with the areas of production.

Vendor's Preference of Seasonality and Fish Species for Sales

Fish catch is generally higher in dry seasons and lesser in rainy seasons in the freshwater systems of tropical Africa. Vendors of fresh and smoked fish generally prefer rainy seasons over dry seasons (Fig. 7). Vendors of smoked fish contend that shortage of fresh fish in the rainy season increases the demand and market value of such fish. We observed a difference of opinion among the vendors of fresh fish. Most of the vendors preferred the dry season because diverse fish species were available; for others, rainy season was better because there was less fish available for distribution. This reflects differences in sales strategies between sellers of locally produced fresh fish (who sell small amounts of variety species which cannot be stocked) and sellers of long-distance traded fresh fish (who sell large amounts of specific species which can be stocked alive).

Vendors of fresh and smoked fish preferred different groups of species for sales; notably, both gave high preference to Clarids (Fig. 8). Vendors of fresh fish preferred small to medium sized catfish of *Clarias* spp. and African lungfish because they are “tough” (i.e., they do not die easily) and available throughout the year. Cichlids and Mormyrids are also preferred by these vendors due to their good

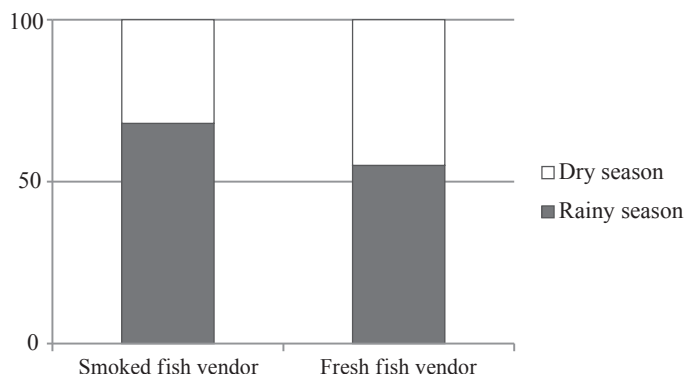


Fig. 7. Vendor's responses on seasonal preferences for commerce: A comparison between smoked fish sellers and fresh fish sellers.

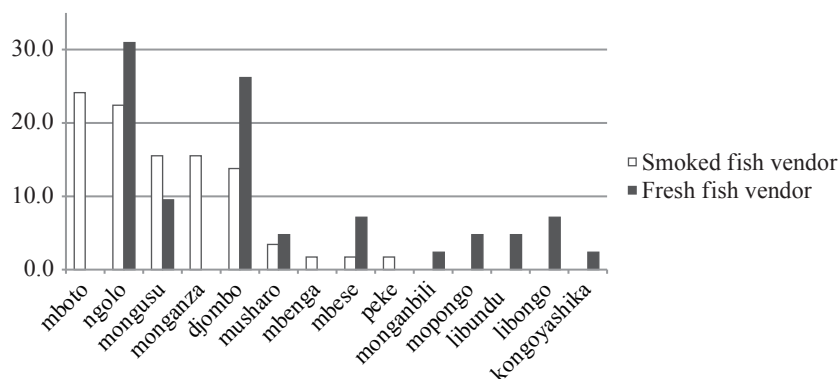


Fig. 8. Vendor's preferences on fish species for sale: A comparison between smoked fish sellers and fresh fish sellers (%).

taste. Vendors of smoked fish preferred *Distichodus* spp. (*mboto*) and large-sized *Labeo* spp. (*monganza*) because of their taste and particular demand in recipes such as pounded cassava leaves with palm oil (*pondu* or *sakasaka*).

DISCUSSION

Merchants act as mediators between the urban market and rural resource production. While urban markets are growing, production of aquatic resources is still at a small scale in the inland waters of central Africa. This paper presents data on (1) patterns of distribution and consumption of freshwater fish in urban areas; (2) trading relationship of fish vendors at the local markets; and (3) perception of fish vendors on variety of fish species as merchandise. Freshwater fish contributes to city dwellers' diet as locally produced animal protein source whereas

the largest source of animal protein procurement is refrigerated animal foods whose considerable part seems to be imported from global market. Fish vendors with different form of merchandise employ different vending strategies. Smoked fish vendors, who treat merchandise with high economic value, are highly specialized. Commodity chains between fishermen, middle persons, and vendors are different for smoked fish, fresh fish, and salted and dried fish. Fixed relationships seem to be a norm between middlemen and vendors, especially in the trade of smoked fish. Such trading relationships are based on ethnic ties linked to the area of origin. This trend is different from the one seen in the Zambezi River floodplain, where fluid relationships exist between market vendors, middle persons, and fishermen. The trend is rather comparable to what Takeuchi (1996) pointed out about the distribution system of cassava between producing villages and urban areas in the Congo. Distribution system of freshwater fish and the other locally produced animal protein sources are linked together with that of agricultural foods by sharing transportation. However, the impacts of intensification in trade between urban area and rural area may differ between agricultural staple food and small-scale fisheries.

Ecological anthropological studies of the 1970s and 1980s have highlighted the unique characteristics of long-lasting trading relationships between fishermen and farmers and merchants, such as the barter market system in the upper Congo River (Ankei, 1984). Even if transaction is made with cash, every freshwater fish species was traded without distinction of market value, and traders did not purchase only specific species of high market value (Imai, 1995). Such local institutions of fishermen and traders not only ensured stable economic benefits for the fishermen but also contributed to sustainable use of aquatic fauna by preventing concentration of catch effort on species with high economic value (Ichikawa, 1994). Further study is needed to examine how increased demand for fish in urban areas is impacting the sustainability of aquatic resources through fixed trading relationships.

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NOTES

- (1) There are no sales of fresh fish and bushmeat on the weekly day off at each local market (for example, Monday at Total, Wednesday at Ouenze, and Friday at Talangai).
- (2) Resident area of informants includes Talangai, Makelekele, Mougali, Potopoto, Plateau des 15 ans, and PK45. Of the ten households, two are the families of government employees. The others include the households of private sector workers and the unemployed.

- (3) In this survey, we also collected the data on main dishes (staple foods). Here we will only report on side dishes as our objective is to know the importance of freshwater fish in urban living people's animal protein consumption.
- (4) FCFA abbreviates for franc CFA, the official currency used in the Republic of the Congo. Fixed rate is that 656 FCFA equals to one euro.
- (5) For chicken and raw beef, we could only count the vending slots at Moundali. So the number here is underestimated.
- (6) These are imported in container boards from northern European countries such as Norway and Sweden.
- (7) The species are called as *malangua* in Lingala, which is a generic name for Schilbeid fish as well as genus name of *Pangasius* because of the similarity in forms.
- (8) Data collected from November to December 2011. We have monitored retail price of animal foods at local markets and will discuss about price dynamics in another paper.
- (9) Smoked freshwater fish is recognized as a home delicious by African diaspora. We can find smoked fish from the Congo provenance which is sold at quite small scale at African towns in the cities of Europe.
- (10) The Lari belongs to the southern part of the country.

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